

MSTA

Dedicated to Quality
Science Education

V.8 No.3

Montana Science Teachers Association

Newsletter

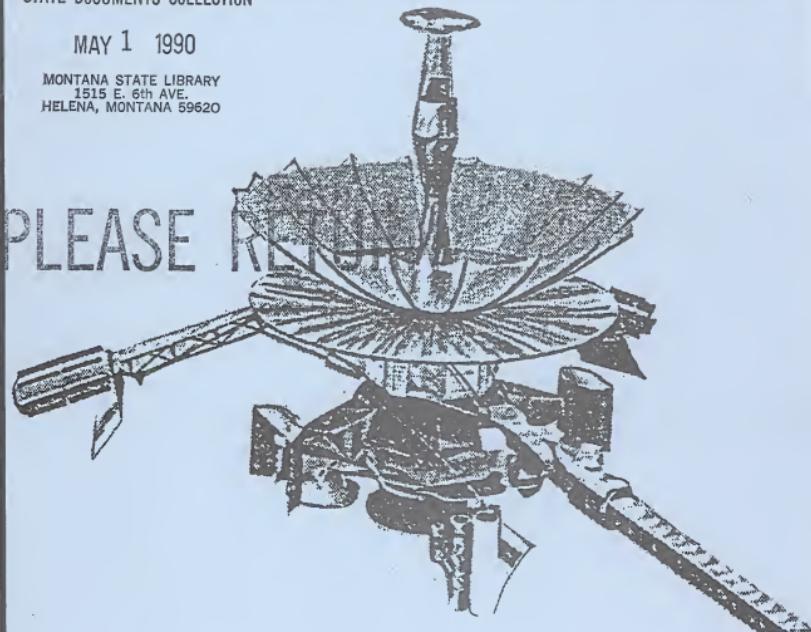
Volume 8:
Number 3

STATE DOCUMENTS COLLECTION

MAY 1 1990

MONTANA STATE LIBRARY
1515 E. 6th AVE.
HELENA, MONTANA 59620

PLEASE RE



Galileo Spacecraft

About the Cover:

The *Galileo* Orbitor/Probe spacecraft will conduct a thorough scientific investigation of Jupiter, its environment, and satellites. About five months before arriving at the planet, the Probe will be separated from the Orbitor and aimed toward the equatorial regions. The Probe will descend some 400 miles into the atmosphere, making the first direct measurements of Jupiter's atmosphere and clouds. The Orbitor will act as a relay link receiving radio data from the Probe and transmitting it to Earth.

In This Issue...

Article	Page
President's Message	1-2
Rainforest Facts	2-3
More Schools Become Smokefree	3
Montana Earth Day	4-5
Smoking Patterns in Montana	6
The Naked Cell	7
Water Quality Guide Available	8
Canyon Ferry Institute	9-10
Chimpanzee Treatment	11
All in the Family	13-14
Profile of Presidential Awards	14
Inquiry: Case of the Shellless Egg	17-18
ACS Student Fellowship Grants	19
Science Research Program	19
Have You Seen... (Directory)	20
NSF Summer Institute	21
Weather Database Materials	21
Laboratory Animal Issue	22-23
Job Available	23
Resources Youth Camp	24
Project Learning Tree	25
Gordon Hahn Report	26-27
Recycling	27
Acid Rain Kit	28-29
Montana AIDS Cases	30

President's Message

Richard Micheletto

Montana Science Teachers Association has seen improvements in science curriculum and teaching at all levels throughout the state during 1989. This was evidenced by the quality and quantity of sectionals and workshops offered by MSTA at the IPD convention in Great Falls in October. In addition, many Montana science teachers attended the National Science Teachers Association convention in Seattle last April, and Montana teachers attended and presented at the NSTA regional conventions in Phoenix and Milwaukee and the OSTA convention in Eugene.

A lot of work goes into preparing a sectional or workshops and all those who shared their ideas and expertise at the convention are to be commended. They truly did a fine job. Hans O. Andersen, NSTA president, was very impressed by the quality of sectionals and hopes to return to Montana to take part in another of our conventions.

Though the Montana Science Teachers Association has short history, it has been a catalyst for change. It is growing in membership, but more importantly, it is increasing the services it provides to science students and science teachers in our state. MSTA has aided Montana students in participating in the National Science Olympiad and the

Junior Academy of Sciences, and has awarded scholarships to attend Canyon Ferry Limnological Institute. By cooperating with BEST, MSAAPT, MEST, the chemistry teachers, and biology teachers. MSTA has worked to provide teachers with excellent workshops.

This past year MSTA instituted two awards programs. One is designed to recognize and honor science teachers who have done outstanding work for their students or their schools. The other is designed to recognize and honor graduating high school seniors who have maintained a minimum *B* average in four years of high school science.

The third year of the BEST Grant concluded with 50 more elementary teachers participating on the MSU campus this past summer. Montana now has 150 elementary teachers who have taken the training to help them become *Better Elementary Science Teachers*. Committees are currently writing more grants for the improvement of science teaching.

As a closing thought, Bonnie Brunkhorst, NSTA president-elect, has given these challenges to science teachers: *Love the kids in the classroom enough to want to make a difference, attend conventions to get new ideas, and become involved in the making of policies in education.*

Rainforest Facts

Rainforests cover seven percent of the earth's land surface, yet contain over half of the known plant and animal species.

Estimated vary, but approximately 50 acres of rainforest are destroyed every minute. An area nearly the size of New York State is lost every year.

At present only five percent of the world's rainforests are protected.

Rainforests grow on a nutrient-poor soil that they have adapted to. When traditional agricultural is practiced on these soils it invariably fails, resulting in a barren wasteland that rainforest vegetation is unable to recolonize. Tropical deforestation is irreversible.

Rainforests purify the air we breath, they metabolize carbon dioxide which causes the greenhouse effect. Having studied the rainforests scientists have concluded that deforestation of the tropics is contributing to global warming and the desertification of earth.

In November of 1988 weather satellite photos revealed 6,000 fires burning in the Amazon basin. The smoke from these fires added significantly to the carbon dioxide in our atmosphere.

Half of Wisconsin's 300 bird species winter in the tropics. If present trends continue they will be extirpated from Wisconsin by 2011. Bird species that do not winter in the tropics are not declining in numbers.

Japanese logging companies in Malaysia will cut down 200 trees to get to one commercially valuable tree.

The vegetation of a rainforest is so diverse that you can walk for over a mile without ever encountering the same tree species twice.

Nearly 200 million people derive

their livelihood from hunting and gathering in the rainforest, or from small-scale cultivation within and around its fringes.

Eighty seven Indian groups have been extinguished by Brazil In this century.

Twenty five percent of all prescription drugs are from tropical plants. Half a million plants still await analysis, and could supply the wonder drugs of tomorrow.

The third world debt is over one trillion dollars. This encourages countries to overexploit natural resources to pay the interest on debts.

The U.S. imports 300 million pounds of beef from Central America every year for hamburgers, luncheon meats, baby and pet foods. Calculations reveal that for each pound of beef produced 55 square feet of rainforest, along with its associated animals, must be sacrificed.

Nearly half the world's rainforests have been destroyed in the last 40 years. In the next 30 the rest are slated for destruction. Unless vigorous conservation efforts are made the majority of living things on earth will become extinct in one human life span.



Shouldn't all schools be smoke free?



More Schools Become Smoke Free

The American Lung Association recently conducted a survey to estimate how many smoking policies exist in Montana's public schools.

Out of 184 schools that responded to the survey, 48% indicated they were smoke free. According to Earl Thomas, executive director of the American Lung Association, a similar survey was conducted in 1984.

At that time, only 15% of the schools were smoke free and 54% provided a smoke-free teachers' lounge.

Results of the current survey reveal:

- 156 or 84% of the schools provide smokefree teachers' lounges
- 95 or 15% felt that new legislation designed to make it easier for schools to become tobacco free would help them develop smoking policies
- over 15% of elementary schools responding already participate in the Class of 2000 project.

Montana Earth Day

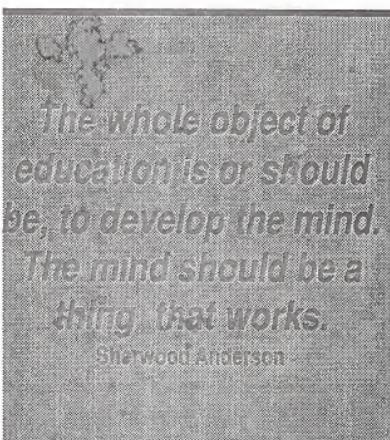
Contact: Jay Sinnott (406) 449-5486
EPA Earth Day Committee

April 22, 1970 was the *first Earth Day*. This was a day on which schools, citizens, the government and the news media paused to focus attentions on a new resolve to protect the environment. A diverse coalition of Montanans is forming plans to make Earth Day 1990, the twentieth anniversary, an equally momentous occasion; an occasion to strengthen the resolve of Montanans to act at every level to save our home—Earth.

On December 12, a kick off meeting was held in Helena in order to spur a consolidated *Montana Earth Day 1990 Celebration Committee*. At this meeting, present plans were discussed and ideas were exchanged for stimulating a grass roots Earth Day 1990 celebration throughout Montana. Attendees shared an impressive array of plans already in motion in Bozeman and Missoula. A Helena Earth Day 1990 committee formed spontaneously out of the meeting.

The Montana committee's challenge is to encourage and assist similar planning in many other Montana communities.

The major categories of observances discussed include: school and college events such as art and essay contests or environmental improvement projects; news media events such as a series of articles on how each Montanan can routinely make decisions which positively impact the environment; environmental improvement projects such as tree plantings or clean ups; awards for businesses which act to protect the environment through routine business practices; spiritual observations; and celebration events such as balls, concerts, art displays, lectures and symposia.



In every country on this planet, man-made environmental problems are being generated faster than we can solve or prevent them. In every country, environmental health capacity is inadequate to meet human needs, even as the problems themselves change, becoming more complex, more critical, more urgent.



*Montana Earth Day
April 22, 1990*

Smoking Patterns in Montana

by *Marsha McFarland, M.Ed.*

Health Education Specialist

*Montana Department of Health
and Environmental Sciences*

The Montana Department of Health and Environmental Sciences conducts monthly surveys of Montanans aged 18 years and older. The survey allows health department officials to estimate the prevalence of behaviors linked to the ten leading causes of premature death among adults in the United States. Those interviewed are selected through a sampling process which provides a *snapshot* of Montanans' health behavior.

In addition to background variables including age, race, sex, height, weight, education and income, those surveyed are asked about cigarette smoking, smokeless tobacco use, and other health-related habits.

Risk factors are analyzed by comparing the background characteristics of smokers with those of nonsmokers. The data are also analyzed to identify other risk behaviors which occur among smokers. A statistical test which measures the relationship between behaviors shows that Montanans who smoke are also at risk for *acute drinking* (consuming five or more alcoholic drinks on at least one occasion during the last month). This test demonstrates that Montana smokers are less likely to use seatbelts, however, smokers are also less likely to be at risk for obesity and hypertension.

Combined data for the years 1984-1988 reveal that 24.2% of Montanans are smokers. Analysis of the aggregate data also provides profiles of Montana smokers and nonsmokers. Data for this five-year

period show that slightly more males than females are smokers (24.3% compared with 24.0%).

By background variable, Montanans who are most at risk for smoking include: unmarried couple (49 %); unemployed (39.4 %); divorced (39.1%); separated (37.3%); and other than white race (34.5%). Those who have the least risk for smoking are college graduates (14.7%); those older than 60 (18.2%); the widowed (18.4%); the retired (18.5%); and those whose incomes exceed \$50,000 annually (18.7%).

By age, the greatest proportion of smokers are from 40-59 (28.7%). Those 60 and over have the lowest percent of smokers (18.2%). Nearly 29 percent of those with reported incomes of less than \$10,000 annually are smokers, while 18.7% of those with incomes of \$50,000 or more are smokers.

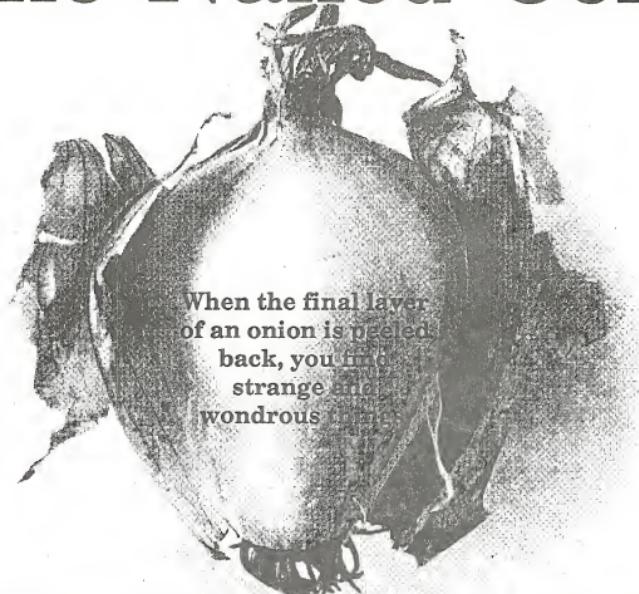
Over the last five years the prevalence of smokers in Montana has decreased from 29.6% in 1984 to 19.8% in 1988.

Source: Reprinted from the *Montana Health Promoter*, volume 1, issue 1, winter 1989. Montana Behavioral Risk Surveillance System, Montana Department of Health and Environmental Sciences, 1984-1988.

***Knowledge is the
only instrument of
production that is
not subject to
diminishing returns.***

J.M. Clark

The Naked Cell

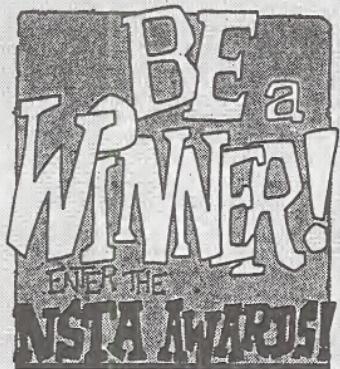


When the final layer
of an onion is peeled
back, you find a
strange and
wondrous thing.

Every cell of every plant lives within a *wooden box*, or wall, composed mainly of cellulose, plus a few other less well-defined compounds. Most plant physiologists now believe that the cell wall is a secretion of the living part of the cell, and not a truly integral part of the living system. The individual cells are cemented together by pectins, the materials used commercially in making jellies. Sometimes the integrity of plant tissue is upset through invasion by wall-digesting molds. As these molds make their way through plant tissue, they secrete two types of enzymes: pecti-

nases, which separate cells from each other, and cellulases, which enable the mold to digest the cell walls and to get at the living contents of the cell. If we extract these enzymes from the mold, we can use the pectinases to separate cellular masses into individual cells, and the cellulases to digest the wall away from the living protoplast inside the cell. We have, then, a technique for isolating and unwrapping the protoplast, or most elemental unit of plant life. The protoplast of a plant cell is an active osmotic system; that is, it will quickly take up water from the surrounding medium

and expand. Normally, the protoplast, like the bladder of a basketball, is restrained by the rigid outer coat, the cellulose cell wall. But once that wall has been digested by the cellulase, there is no limit to expansion. The protoplast will absorb more and more water and swell until finally, like an overblown balloon, it bursts. To protect the protoplast against such an untimely end, you simply add osmotically active material, such as mannitol (a sugar alcohol), to the medium around the cell. The protoplast becomes equilibrated and does not swell further.



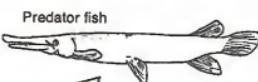
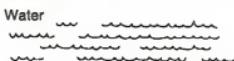
The 1991 award programs information will soon become available. Should you wish to receive information on these programs, list your name and address and a copy of the above promotion and return to the following address:

National Science Teachers Association

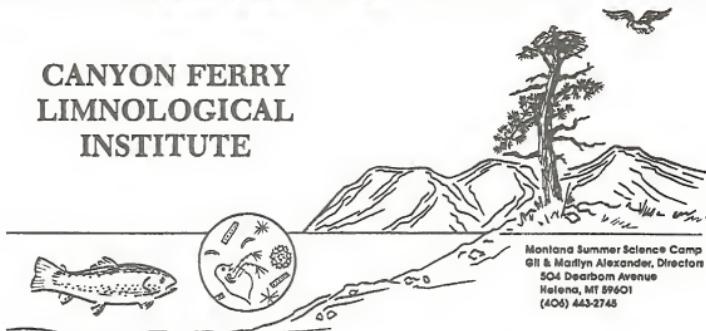
1742 Connecticut Avenue, NW
Washington, D.C. 20009-1171

Water Quality Indicators Guide Available

With more than fifty years experience in soil and related resources, The U.S. Soil Conservation Service has recently released the *Water Quality Indicators Guide: Surface Waters*. The *Guide* employs a simplified approach, allowing the user to learn the fundamental concepts of water quality assessment quickly. The *Guide* extracts basic tenets from many disciplines, such as geology, hydrology, biology, ecology, and wastewater treatment, and focuses those ideas in making decisions about water quality. This publication is an excellent resource for any science classroom and is available at your local Soil Conservation Service (SCS) office.



CANYON FERRY LIMNOLOGICAL INSTITUTE



Montana Summer Science Camp
Gill & Marilyn Alexander, Directors
504 Dearborn Avenue
Helena, MT 59601
(406) 443-2748

The seventh summer session of this *research institute* will be held from June 18 - July 27 at the Bureau of Reclamation facility on scenic Canyon Ferry Lake near Helena, Montana. There are four overlapping sessions which address specific needs of the selected participants.

The overall objective of the program is to involve students and teacher participants in hands-on field and laboratory research of real scientific problems and to establish a data base of information which is of value to water quality regulatory agencies. High school students and inservice teachers learn to use state of the art diagnostic analytical instrumentation interfaced to computers as they learn standard aquatic sampling methods and techniques. Participants work in close association with resource scientists from universities, industries and state and federal regulatory agencies.

Application forms will be available March 1st. The application deadline is May 1st. Late applications may be accepted if the sessions are not filled. Notification of disposition of applications will be sent May 15th. Fee payments for successful applicants are due June 1.

Session I June 18 - July 27 (HIGH SCHOOL) \$700

Independent Research Problems for high school students who are working on an independent research project. Directors must approve student's initial project design prior to June 1st. Students are expected to collect and analyze data and complete 1st draft of research paper during this session.

Sci 195 - 4 credits from University of Montana

Prerequisite: Completion of *Introduction to Aquatics Research* during summer of 89,

Session II July 2 - July 13 (HIGH SCHOOL) \$500 Limit 20

Introduction to Aquatics Research - for high ability high school students who have completed 9th or 10th grade.

Session III July 16 - 20 or Session IV July 23 - 27 (ENTERING HIGH SCHOOL)

\$250 Limit 16 per session

Skill Building for Scientific Research - for high ability high school students who have completed 8th grade, but have not begun 9th grade.

Session V July 16 - July 27 (TEACHERS) \$500 Limit 20

Bio 580 - *Field Methods in Aquatic Science* from Montana State University for teachers of grades K-12. No prior science background necessary. Teams will be grouped by science background and grade level. Three graduate credits can be applied to a Masters in Science Teaching at MSU. Qualifies for Eisenhower Grant funding through your school district.

Montana only:

Missouri River Water Quality Network Pilot Project

Fees paid through McAuliffe Grant

July 16 - July 27 (MONTANA TEACHERS and ONE STUDENT EACH of their CHOOSING)

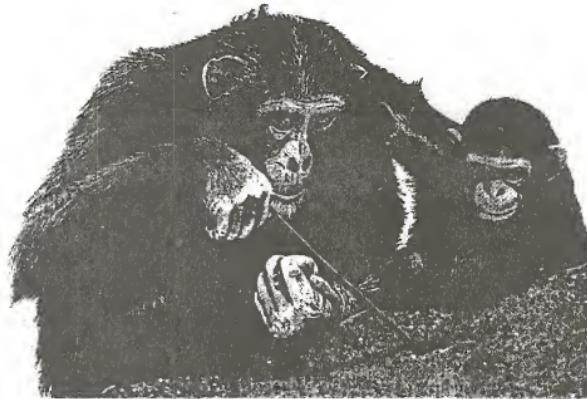
Bio 580 - *Field Methods in Aquatic Science* from Montana State University for high school teachers who teach near the Missouri River in Montana. Teachers must have cooperative agreement with their school district to take students on field trips to sample and analyze water from the Missouri on four simultaneous specified dates during the school year. Participants must also have the availability of a computer with a modem. Teacher participants will receive stipends and water analysis equipment.



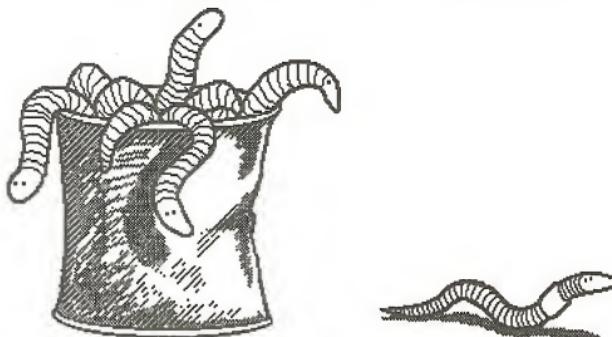
Send requests for applications to

Gil and Marilyn Alexander, Directors
Canyon Ferry Limnological Institute
504 Dearborn Avenue
Helena, MT 59601

or call: 406-443-2745 evenings

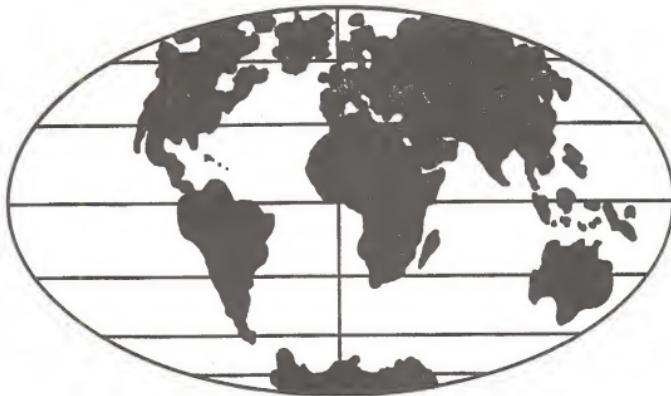


Humankind's treatment
of our mentally impaired
reflects care, love, and
compassion...do we owe less
to our cousins, the
CHIMPANZEEs?



Explore Earth Science

Enrich your courses with new books from
the National Science Teachers Association



Earth: The Water Planet

This new book from NSTA shows you how to use readily available materials and a variety of instructional methods to investigate how water shapes our planet and our daily lives. Included are hands-on experiments challenging you to purify swampwater, conservation-oriented activities showing how much water is wasted by a dripping faucet, and a role-playing activity in which students present opposing arguments at a town meeting. Appropriate for both inservice workshop and classroom use, the activities are close to life and fun, and demonstrate that there is indeed water, water everywhere on Earth.

1989, 204 pp. \$16.50, grades 6-10

Earthquakes

Shake up your classes with these lesson plans developed by NSTA under a grant from the Federal Emergency Management Agency. The book's six units are divided into three levels: K-2, 3-4, and 5-6; the first four units deal with the science of earthquakes, and the last two with disaster preparedness. The teachers who developed this complete earthquake curriculum have designed it for use in combination with lessons in art, math, language arts, and social studies to provide you and your students with a true interdisciplinary experience. Included are 63 line masters, background information, classroom activities, earthquake legends, and scope and sequence.

1989, 288 pp. \$15.00 soft cover or 3-hole punch., K-6

Orders of \$25 or less must be prepaid. Purchase orders may be used for orders over \$25. All orders must include postage and handling fee of \$2. No credits or refunds for returns. Send order to: NSTA Special Publications, 1742 Connecticut Ave., NW Washington, DC 20009

NSTA

All in the Family

Marilyn Alexander, a 1989 Presidential awardee who teaches chemistry to 11th and 12th graders at Helena Capital High School in Helena, Montana, was not the first in her family to earn the honor. Her husband Gil, an earth science teacher at Helena High School, was a 1987 Presidential Award winner. Two other 1989 awardees have spouses who received the award in previous years. Beverly Van Camp, 1989 award winner in math, saw her husband Warren accept the award for science in 1986. Floramma Stanislaus was also a 1989 awardee in math; her husband Joseph accepted the award in 1986 for science.



All this is by pure coincidence because the National Selection Committee changes each year, and committee members consider only the nominees submitted to them that year.

The Alexanders have been NSTA members since the early '70s. They're also active in their state group, the *Montana*

Science Teachers Association (Gil is president-elect). Marilyn and Gil direct the *Canyon Ferry Limnological Institute*, a summer science camp for teachers and for gifted and talented high school students (see pages 9-10). About eight years ago, when the area lost NSF funding for extracurricular science activities and programs, Gil and Marilyn envisioned another way to take science beyond the classroom. They also realized that after elementary school, few gifted and talented programs exist. The institute is held all summer long, with students attending in two-week sessions. Students must apply to attend the institute: generally, 20 students are enrolled in each session. *At least 50 percent of students are female*, Marilyn said. *We have much success with the girls because often they are more academically oriented.*

During the students' first summer at the institute, they become acquainted with the basics and methods of freshwater limnology. Returning students undertake independent research projects. Second-year students can receive four undergraduate credits through the University of Montana.

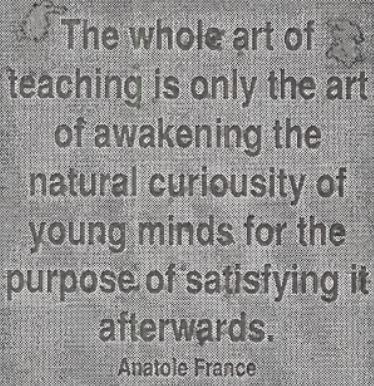
Participating teachers also can earn

graduate credit. The institute is particularly useful for teachers who have little or no background in limnology. Next year the Alexanders plan to expand the institute to elementary teachers because as they said, *If you want to produce scientists or a scientifically literate public, you need to start when students are young.* Both of the

awardees emphasized that they could not have been as successful as they have been in running the institute without the help of supportive administrators in their district. Marilyn plans to use the \$7,500 grant she received and get matching funds from the school district, Montana's Office of Public Instruction of the Gifted and Talented, and industry. This money will help run and improve the institute—including helping to pay for teachers' salaries, equipment, machinery, and other necessities.

After receiving their awards, both Marilyn and Gil felt compelled to become *squeaky wheels* at home. *We felt that we had a greater obligation to be advocates for science education*, Marilyn explained, *to do even more work than before we won the award.* Part of that sense of obligation means being a voice to the legislature, speaking out for science and science educators. In this way, they said, they hope to make people believe that what teachers do is important—and at the same time help the teachers recognize that, too.

Cara Young, Managing Editor,
NSTA Reports reprint,
January 1990.


The whole art of
teaching is only the art
of awakening the
natural curiosity of
young minds for the
purpose of satisfying it
afterwards.

Anatole France

Profile of the 1989 Presidential Award Winners

Of the 54 science teachers

45 teach high school
9 teach middle/junior high school

18 are women
36 are men

Of the high school teachers

18 teach physics
15 teach biology/life science

3 teach earth science
1 teaches physical science

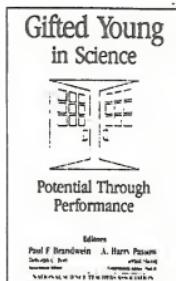
Of the middle/junior high school teachers

3 teach earth science
1 teaches physical science
3 teach general science
2 teach biology/life science

Learning Science

with the National Science Teachers Association

Theory...



Gifted Young in Science Potential Through Performance

Is there a promising student in your class or in your family who might love science? *Gifted Young in Science*, the first book in over 30 years devoted to talented science students, will help you encourage them. Thirty-four scientists, teachers, and scholars show you how to create the experiences and environments that encourage any child to uncover special talents in the wide field of science. Steven Jay Gould, Isaac Asimov, Joshua Lederberg, Lynn Margulis, Glenn Seaborg, and other award-winning workers in science offer the experiences which helped them choose their fields. And *Gifted Young in Science* describes methods—based on sound findings in philosophy and psychology—for administering programs for gifted students, designing their curriculum, and helping them excel. The NSTA created this volume to help educators and parents guide students to the excitement of science.

#PB-75/1, 1989, 422 pp. \$24.00/hardback

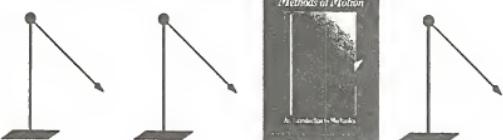
#PB-75/2, 1989, 422 pp. \$17.00/soft cover

Methods of Motion

An Introduction to Mechanics, Book 1

How do objects move? Isaac Newton really believed that an object moving in a straight line would continue with constant speed. Do your students? This manual was created to help teachers introduce the sometimes daunting subject of Newtonian mechanics to students in the middle grades. The 27 activities presented here use readily available materials to give students visual, aural, and tactile evidence to combat their misconceptions. And the teacher-created and tested modules are fun: Marble races, a tractor-pull using toy cars, fettucini carpentry, and film container cannons will make teachers and students look forward to class. Readings for teachers, a guide for workshop leaders, and a master materials list follow the activities, making this manual useful for inservice workshops.

#PB39, 1989, 168 pp. \$16.50



...Into Practice!



All orders of \$25 or less must be prepaid. Orders over \$25 must include a purchase order. All orders must include a postage and handling fee of \$2. No credits or refunds for returns. Send order to: Publications Sales, NSTA, 1742 Connecticut Ave. NW, Washington, D.C. 20009

NSF announces New Award

The 1990 Presidential Awards for Excellence

has been expanded
to include elementary
science and mathematics teaching

In Science and Mathematics Teaching

National Science Foundation

The Presidential Awards for Excellence in Science and Mathematics Teaching was established in 1983 to identify outstanding secondary teachers of science and mathematics who can serve as models for their colleagues. For 1990, NSF has expanded the program to include the recognition of elementary teachers who teach science and elementary teachers who teach mathematics.

The Award

A \$7,500 National Science Foundation grant to the awardee's school to be spent under the awardee's direction.

Gifts to the awardees and their schools from donors in the private sector.

An expenses-paid trip for the awardee and spouse/guest to Washington, DC, in October for a series of recognition events and meetings.

Eligibility

- Teachers who are assigned at least halftime during the school year to elementary classroom teaching of science and/or mathematics in a public or private school in the United States or one of the eligible jurisdictions and who anticipate an elementary classroom teaching assignment for the 1990-91 school year. Teachers on approved leave in 1989-90 qualify if they fulfilled the requirements in 1988-89.
- At least five years teaching experience with responsibility for science and/or mathematics.

Guidelines for Nomination

The teacher nominees will:

- be knowledgeable in the subject matter of science and mathematics;
- demonstrate an understanding of how children learn science and mathematics;
- engage students in activity-oriented experiences and direct hands-on science and mathematics;
- foster curiosity and generate excitement about science and mathematics in students, colleagues, and parents;
- demonstrate, through their teaching, their conviction that all children can and should learn science and mathematics;
- be sensitive to the needs of students' cultural, linguistic, learning, and social differences;
- have an understanding of the relationships of science and mathematics to learning, to each other, and to the interconnectedness of all subject matter; and
- possess an experimental and innovative attitude in their approach to teaching.

Form may be copied

OMB No. 3145-006

ELEMENTARY NOMINATION FORM

1990 Presidential Awards for Excellence in Science and Mathematics Teaching

Please type or print clearly

I nominate _____ in Science Math

(Teacher name)

(School name)

(School phone)

(School address, city, state, zip)

as a candidate for a Presidential Award for Excellence in Science and Mathematics Teaching.

(Signature)

(Name)

(Title or connection with nominee)

Nominations must be postmarked by March 19, 1990.
All nominees will receive nomination packets, which
must be completed and returned by April 23, 1990.
Please notify this teacher that you have nominated her/him.

Please send this form to:
Elementary PAESMT
c/o NSTA
1742 Connecticut Ave., NW
Washington, DC 20009-1171

Inquiry: Case of the Shellless Egg

Materials:

Fresh Egg	5N HCl
String	400 ml Beaker
Glass Stirring Rod	Distilled Water
Centimeter Ruler	Waterproof Marker
	Eye Goggles



Procedure:

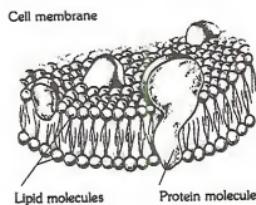
1. Make measurements of the size of your egg. Measure circumference at its largest diameter and length. Measure with a string and then measure the string.
2. Wearing goggles, put the egg in 5N HCl (5N hydrochloric acid is made by adding 45 ml of acid to 155 ml distilled water). **CAUTION: Never add water to acid, always acid to water.** Egg, acid and water go in a 400 ml beaker.
3. Rotate the egg and keep it submersed using a blunt glass stirring rod. While the shell is being removed you may wish to proceed to a sink.
4. Gently rinse the shellless egg after the entire shell has been removed. You are now looking at a living cell membrane. The egg can be removed from the beaker by gently dumping it from the beaker into the palm of your hand.
5. Mark the surface of the egg with two lines 1 cm apart with a waterproof felt pen. Place in the same 400 ml beaker with a measured amount of distilled water that will cover the egg. Set aside for 24 hours.

Data:

Discussion:

1. What changes have occurred with your egg?
2. What caused these changes?
3. What characteristics must the cell membrane of your egg have?

Conclusion: (HINT: You might explain what materials pass through the cell membrane and which materials do not.)





1990 Student Fellowship Grants

A great opportunity awaits several young Montana science students through the American Cancer Society's Student Fellowship Program. The purpose of the program is to stimulate interest among students in pursuing a scientific career by giving them the opportunity to work in a research environment for 8-10 weeks during the summer.

Scientists from several institutions across the state, including the University of Montana, Montana State University and McLaughlin Research Institute, serve as supervisors and instructors during the fellowship.

CONTACT PERSON:

E. Stan Wieczorek
Executive Vice President
American Cancer Society
Montana Division, Inc.
313 North 32nd Street, Suite 1
Billings, Montana 59101

406•252•7111

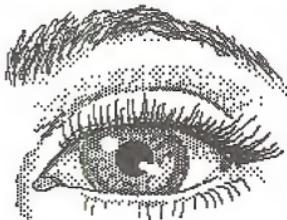
High School Science Teachers Research in Physiology Program

The APS has initiated a new program aimed at providing high school science teachers with experiences in research in physiology. The *High School Teachers Research in Physiology Program*, scheduled to start in 1990, will be carried out through the awarding of grants on a competitive basis to individual members of the APS.

Grant awards will be based on the overall quality of the program planned for the high school teacher. Information and applications can be obtained from the H.S. Science Teachers Program, APS, 9650 Rockville Pike, Bethesda, MD 20814.



Have You Seen



Montana's Conservation Education Resource Directory?

Montana's Conservation Education Resource Directory provides a wealth of information to teachers teaching natural resource or related subjects. The directory lists:

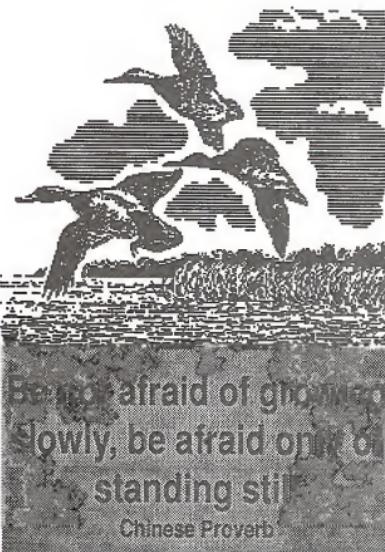
- 1) All teacher training programs in Montana (for credit);
- 2) Extra-curricular youth programs;
- 3) Example school year programs in conservation education; and
- 4) Curriculum resources for teachers and other natural resource educators.

These directories were sent to every school librarian in Montana in Spring 1989. The directories should have been placed in teacher lounges or other accessible places.

The Directory is most current for 1989 and 1990 and will provide a valuable resource to teachers seeking continuing education credit.

If you do not have a directory in your school, please contact the MT Department of Natural Resources and Conservation at 444-6667 or 1520 East Sixth Ave., Helena, MT 59620-2301 to request one.

If you have found the directory useful and would like to receive an updated 1991-1992 directory, please contact the DNRC office (above).



Be not afraid of growing slowly,
Slowly, be afraid only of standing still.

Chinese Proverb



TSONGAS INDUSTRIAL HISTORY CENTER

High School teachers of social studies, science, math, and industrial technology are invited to apply for a three week summer institute sponsored by the National Science Foundation and directed by the Tsongas Industrial History Center/University of Lowell.

Under the heading of *New Perspectives for Teaching the History of Science, Technology, and Industry in American Society*, the institute will bring 29 teachers together with scientists, engineers, and historians in an effort to discover how topics can be used effectively within current curricula to stimulate student interest in science and technology. Titled *Roads, Rails, and Runways: Transportation and American Society* the institute will concentrate on the development of transportation technologies and the critical role that transportation plays in sustaining and changing society.

The institute, to be held in Lowell, Massachusetts from July 5 through July 25, 1990, will provide content lectures, site visits, and workshops. Participants will each receive 3 ULowell graduate credits plus a \$900.00 stipend. A limited number of housing and travel scholarships are available. The application deadline is March 30, 1990, and the announcement of participants will be made before April 30, 1990.

Application inquiries should be sent to the Tsongas Industrial History Center, University of Lowell, 1 University Avenue, Lowell, MA, 01854, (508) 459-2237.

Weather Database Materials

If you've been searching for affordable, practical weather database software for use in your earth science classes, look no more! Check out National Geographic's Weather Machine! The 128K Apple software processes NOAA products with pull down menus which access upper air color maps, surface maps, overlays, and individual station data. Telecommunication is simplified with a receive mode built into the software which connects with National Geographic's electronic bulletin board via a toll-free number. This permits the user to pay a one-time fixed charge per year, an important consideration when dealing with budgets! One data feed per day is allowed, with the information updated at 7 am eastern time. All you need is an Apple IIc, IIe, or GS with a modem and access to a phone line. This product may be purchased with or without the database service. The cost for the telecommunications service is \$160 if purchased before December 31st, 1989. The software kit alone is \$159.95. For further information contact National Geographic Society, (800) 368-2728.

Laboratory Animal Issues Broadened with New Focus on Use by High Schools

For more than a century the question of the use of laboratory animals was an issue that focused primarily on research laboratories. With the advent of the animal rights movement a decade ago the question of animal use was broadened into areas concerned with the utilization of animals for food, work, clothing, and entertainment.

The newest target now for the animal activists is the use of animals in high school biology classrooms for the purposes of teaching and dissection.

A national campaign to encourage students to oppose dissection on ethical issues has been initiated by the Animal Legal Defense Fund (ALDF), a national network of 300 lawyers who argue that biology is a life science, not a death science, and that dissection teaches that animal life is expendable and unimportant.

The *Students Against Dissection* campaign was started by ALDF in October with an announcement in the nation's press of a telephone hot line for providing support and information to both students and teachers and with the showing of a daytime network television program dramatizing how a high school student's refusal to dissect a frog led to a California law giving students the right to refuse to dissect an animal.

ALDF's sponsored hot line (1-800-922-FROG) provides students with information about their legal rights, alterna-



tives, how to consult with school officials, and referrals to local attorneys who will represent their interests. Students also receive the handbook, *Objecting To Dissection*.

The goals of the hot line are to help students defend their right to an education in accordance with their ethical beliefs and to change the way biology is taught in the classroom. ALDF also is working to assemble a battery of test cases to prove that students have a First Amendment right not to dissect an animal if dissection conflicts with their ethical beliefs.

CBS network's *Schoolbreak Special* dramatized Jenifer Graham's legal fight to avoid the dissection of a frog in her high school biology class. Graham filed suit

against the school district last year in the Los Angeles Federal District Court. The suit was dismissed after school officials agreed with the judge's plan to allow Graham to view photographs



to identify body parts of a dissected frog that had died from natural causes.

Graham, a vegetarian who opposes killing animals for scientific purposes, refused to dissect a frog and received a zero for the assignment, which lowered her course grade from an A to a B. She had asked to be permitted to use models of a dissected frog, but the school said models could jeopardize the school's credibility with universities.

In her suit, Graham, then 16, contended that school officials had violated her rights by ordering her to dissect a frog that had been killed for scientific purposes. Her lawyers considered appealing the dismissal of the suit, suggesting that the school would have a hard time finding a frog that had died of natural causes and that was in good enough shape to serve the purpose.

school said
models could
jeopardize
credibility with
universities

When Graham filed the suit she became a centerpiece for the animal rights movement, appearing on talk shows and television commercials, including a commercial for Apple Computers demonstrating a computer mock up of a frog she said would serve as well as a dead frog. The computer firm said it dropped the commercial because the animal rights issue was getting more attention than the computer.

The case was the impetus for the enactment of a California law that gives students the right not to dissect an animal. Although no other state has approved such legislation, similar legislation is expected to be considered in 1990 in several state general assemblies.

William M. Samuels



Job Available

United States Fish & Wildlife Service is looking for two volunteers to work at *Red Rock Lakes National Wildlife Refuge* in southwestern Montana from May to August 1990. The positions require people who can commit their entire summer to this project and are willing to work full 40-hour weeks. There will be little financial compensation but it should be a rewarding educational experience, and there are a wide variety of outdoor recreational activities available after work. These should be ideal positions for biology or environmental education teachers looking to expand their experience in wildlife field work.

WANTED: 2 VOLUNTEERS, Red Rock Lakes Nat'l Wildlife Refuge, Montana, for wildlife research/monitoring, habitat improvement, and refuge maintenance. May-Aug '90. \$16 per diem & free housing provided. For details & application, contact Janissa Balcomb, RRLNWR, Mo-nida Star Rt., Lima, MT 59789. (406) 276-3347. Application deadline: March 1.



The Fourth Annual Montana Natural Resources Youth Camp August 5-11, 1990 Lubrecht Experimental Forest

35 miles northeast of Missoula

THE CAMP

Youth ages 14-17 spend one week each summer in a rustic setting learning about Montana's natural resources. The accommodations are comfortable, the food is great, and the instruction and friendships are the best! Students receive instruction in many natural resource program areas, attend Learning-Through-Discovery workshops, and have plenty of time for fun and meeting fellow campers. Evening activities include guest speakers, night hikes, campfires, and singing. The fun and learning never end!

THE PROGRAM INCLUDES

- Forestry
- Water
- Soils
- Range
- Wildlife
- Survival Skills
- Recreation Management

In addition . . .

- Learning-Through-Discovery workshops on many interesting topics
- Half-day field trip to the Blackfoot River or Placid Lake.
- Half-day rappelling (optional).
- Leadership training.
- Outdoor recreation.

IT'S FUN, FUN, FUN!!!

SEE YOU THERE!!!

CAMP PURPOSE

... To help our youth develop the knowledge and skills necessary to make difficult decisions regarding the future management, conservation, wise use, and protection of Montana's natural resources.

THE YOUTH

The camp is open to all youth between the ages of 14 and 17, with a maximum capacity of 55 campers. Campers are accepted on a first-come basis. Outstanding campers may apply to return the following year as senior leaders. In addition, space has been reserved for up to 10 adults to participate in the program.

THE STAFF & SPONSORS

All camp instructors are experts in their fields with many years of professional and teaching experience. Last year's kids say, "They're tops!"

The camp received broad support and sponsorship from state and federal agencies, industry, conservation organizations, professional societies, service organizations, and private individuals. These groups develop and help teach the camp program, provide donations and in-kind services, and supervise all aspects of the camp.

EQUIPMENT & TRANSPORTATION

Each camper must bring a sleeping bag or bedroll, enough clean clothes for a week, warm jacket, rain slicker, and toilet articles (towels, soaps, comb, etc.). Musical instruments are welcome.

Campers can bus directly to Lubrecht Forest on Highway 200 or may arrange for a ride from Missoula by noting the date and time on their application.

COST

The full cost of the camp is \$135.00 and includes meals, supplies, and lodging. The camper is expected to pay \$50.00. Sponsors provide the remainder of the funds. Possible sponsors include your local conservation district, area businesses, professional organizations, and service clubs.

Applications may be obtained from your local Conservation District, county extension agent, or science teacher. Applications must be received by June 15, 1990

PROJECT LEARNING TREE...ALIVE AND WELL IN MONTANA

Kathy Anderson, Montana Wood Products Association's Communications Director, had the privilege of attending the National PLT Coordinators Conference in Manchester, New Hampshire. The conference was attended by representatives from 48 states and Quebec sharing ideas, frustrations and successes of this past year's efforts with PLT.

Jane Difley, Regional Manager for the American Forest Council, addressed the MWPA annual convention in Whitefish, September 29, introducing the group to Project Learning Tree. There was a barbecue Thursday evening which hosted a fund raiser event auctioning a signed George Blanda (retired Oakland Raiders kicker) football and sweatshirt. \$300 was raised for PLT that evening. THANKS GEORGE!!!

Various groups throughout the state continually seek to dedicate individuals committed to PLT's success. As a result, a planning group has met to coordinate the program's



efforts and is currently approving a state program guide. Upon approval, the group will help put together a steering committee who will work with the sponsors and coordinators to ensure training of classroom teachers as well as new facilitators (by demand). Project Learning Tree has nowhere to go but UP UP UP!!!

The Montana Wood Products Association is excited to join the ranks with the Office of Public Instruction, the Montana Cooperative Extension Service, US Forest Service and the countless classroom teachers involved with making PLT

the success it is today. Show your support today by: adopting a school system, donating in-kind services or the *green stuff*, sponsor a teacher training workshop or becoming an approved trained facilitator.

**There are no days in life
so memorable as those
which vibrated to some
stroke of the
imagination**



Gordon Hahn Reports

As recipient of the UM/AWU *Montana Outstanding Secondary Science Teacher Award*, I had the opportunity to accept an eight week research position at the Solar Energy Research Institute (SERI) in Golden, Colorado. My family and I relocated to the Denver area for the duration of the eight week program from June 19th until August 11th. The position at SERI was basically an 8:00-5:00 job five days a week. Although the hours were somewhat flexible, the total time put in was around 40 hours a week. SERI is a government supported research facility operated and funded by the Department of Energy (DOE).

Once I arrived at SERI I was placed under the direction of Dr. Lew Brown. Dr. Brown was responsible for the microalgea division of the synthetic fuels brance at SERI. It appeared to me kind of odd that microalgea work would be performed at a solar energy facility. Yet, one of the goals of solar energy is renewable and alternative energy sources that would use the sun as its primary source of energy. Many forms of microalgea, through the process of photosynthesis, produce large amounts of lipid material. There is already a chemical conversion process which will change the lipid material directly into usable fuels for man. One of the goals of the microalgea division is to splice DNA material in to a strain of microalgea which would cause it to make unusually large amounts of the lipid material. When the microalgea is created, it would be placed into very large ponds in southern New Mexico. These ponds, which the DOE owns, are huge saline ponds which are too salty to be used for irrigation or other useful means. By planting high lipid producing microalgea

into these ponds, and skimming off the lipid by-product, one can generate a substantial amount of synthetic fuel. It is hoped that 5% of all petroleum fuels will eventually come from such a source within 10 to 15 years.

Gene splicing into microalgea is a new and very difficult process. Bacterial DNA splicing is very common and well understood, but microalgea propose some special problems. First, the microalgea contain a tough and rigid cell wall. Getting the gene material through the cell wall is very difficult and weakening the cell wall generally kills the algea. One must find a way to introduce the DNA material into the cell without killing the algea itself. Second, bacteria are also present with the microalgea. It is very difficult to determine if the DNA has entered the microalgea or if the bacteria present is giving false information. Therefore, obtaining bacteria free microalgea is mandatory before DNA splicing can be productive. This process is very difficult. Microalgea are often sensitive to antibiotics and any contamination at all will introduce a strain of bacteria to your culture.

Much of my project involved obtaining bacteria free cultures of microalgea (called axenic cultures). Approximately 50% of my time was devoted to this alone. Using aseptic techniques, a dissecting scope and a micro-manipulator, I attempted to extract single microalgea cells free of bacteria. This was no easy task. It would take all day to collect the samples and then a week or better to see if microalgea would even grow. Once you had a growing culture, you had to test for presence of bacteria which could take up to two weeks. After all this was accomplished, you might have one or two axenic cultures that could be used for DNA work.

The rest of my time was spent doing DNA workup on and for algea. I extracted

DNA from cells and then, by using specific enzymes, I would *cut* them into smaller pieces. It was very important to determine how DNA would cut and how stable the fractions might be. Using electrophoretic gels, I was able to identify the behaviors of the cut DNA. SERI had to be able to determine if DNA was ever taken up by the microalgea when gene splicing was performed.

In all, the program was very good. I was exposed to many new ideas, techniques and instruments. The people at SERI were definitely very helpful and supportive. The program included a stipend from SERI of \$500 per week plus a \$1000 relocation allowance. In all, I made \$5000 from the program and used the money to buy a used boat and camper while in Denver. This, plus the experience, made it a very rewarding summer.

I understand that the program has changed for the upcoming summer. The DOE is handling the process on their own and a person applies for the summer research program through them. I don't know how a person goes about obtaining this information. I am more than willing to help anyone who is interested in the program. If I can be of any assistance in getting candidates for such a program, don't hesitate to ask. I gained a lot from the program and I am happy to return the favor.

Respectfully submitted,

Gordon P. Hahn
Teacher
Glasgow Senior High
Glasgow, Montana 59230

228-2485

Paul Dorrance Accepts Associate Award

Paul Dorrance of Helena has accepted an appointment to take part in the Department of Energy Teacher Research Associate Award program. Paul will be assigned to the Pacific Northwest Laboratory (PNL) from June 25th through August 17th, 1990.

We will expect a report from Paul after his appointment has been completed.

Recycling

The *Council for Solid Waste Solutions* based in Washington D.C. is focusing its attention on recycling as one of the most effective ways to reduce the volume of plastics in landfills and to conserve and reuse valuable natural resources.

The July 17 1989 issue of *Time* magazine has an excellent 12 page section on *The Urgent Need to Recycle* sponsored by the Council for Solid Waste Solutions. It represents a report card on what is being accomplished in the United States toward recycling and solving our enormous waste problems.

For a reprint of *The Urgent Need to Recycle* write to:

**Council for Solid Waste Solutions
Office of Community Information
P.O. Box 27599
Washington, D.C. 20038-7599**

EN+ ENVIRONMENT
EN+ ENVIRONMENT
ENVI ENVIRONMENT

Public Focus

520 Transit Road
Victoria B.C. V8S 4Z5
Voice: (604) 598-2910
FAX: (604) 598-2432

489 College St., Suite 500
Toronto ON M6G 1A5
Voice: (416) 967-5211
FAX: (416) 967-4450

Backyard Acid Rain Kit (BARK) 90 Program

General Background

Public Focus is a registered non-profit organization dedicated for over a decade to the development of environmental education programs for students of all ages. Using innovative programs and special projects we enhance the awareness of environmentally crucial conditions, throughout the educational and general community. Through these efforts an appreciation for the restoration and conservation of our environment can be instilled into the emerging generations of young adults.

Acid rain is an environmental hazard that is widely discussed in terms of its environmental and political impact. It is important that young people in both rural and urban centres understand the degree to which they are affected by acid precipitation, as well as how these effects can vary geographically.

BARK 90

Public Focus' Backyard Acid Rain Kit (BARK) 90 Program is a bi-national acid rain monitoring project designed for approximately 120,000 children aged 9-12 years. The program is bilateral, covering all 10 Canadian provinces and 16 American states bordering Canada. Young people taking part in this study will discover in realistic terms where and why acid precipitation occurs. Rather than viewing acid rain as simply a frightening, amorphous issue, they can actively participate in a valid scientific study by monitoring pH levels in precipitation during a precise month-long + investigation.

Part of the program involves the twinning of junior school classes (grades 5, 6 and 7) from participating provinces and states. Although Ministries of Education and State Education Department Officials will be informed of the BARK Program, it will not be part of the official school curriculum. It will represent a non-formal, optional exercise intended to complement environmental and science studies in the classroom.

Timing

Initial research and early communication began in August 1989, with registration and twinning to be completed early 1990. The twinning of an American class with a Canadian class will promote sharing of data and other research specifically relating to BARK, as well as cultural, current affairs and geographic exchanges before, during and after the actual monitoring period.

All Program participants will receive the BARK kit in September 1990 and monitor pH levels in local precipitation during October and early November. Participants will record daily weather and precipitation information (if applicable) on a "Daily Recording Card". Program Newsletters (produced by Public Focus) will inform participants of the progress of the program throughout the BARK 90 session.

Upon completion of the precipitation monitoring in early November 1990, all participants will mail their Daily Recording Cards to Public Focus. Results will be processed by a recognized scientific institution along with guidance from scientists at Environment Canada at the Canada Centre for Inland Waters in Burlington, Ontario. These results will be tabulated and computer mapped. All written reports will be produced in both English and French. Once prepared, the data will be distributed to participants' national media in Canada and the United States. The publication of results will provide all participants and the general public with the knowledge accumulated through the joint effort of these young scientists.

THE BACKYARD ACID RAIN KIT (BARK) 90 PROGRAM

Public Focus, a non-profit environmental education organization is pleased to present the Backyard Acid Rain Kit (BARK) 90 Program. BARK 90 is a scientific acid rain study for students in grades 5, 6 and 7. Classes will test pH levels in precipitation, using a specially designed monitoring kit during a specific period in October/November 1990. Along with pH levels students will make daily recordings of other weather conditions such as; wind direction and type of precipitation and cloud cover.

Participating classes will start receiving information packages dealing with acid rain facts and issues as well as detailed information about the BARK 90 Program in early 1990 after they have sent in registration form and payment. It is important to note however that the actual monitoring kit will be sent out in early September 1990, with the monitoring period taking place in October and early November 1990. Though it will be next year's class taking part in BARK 90, teachers may want to communicate early with their "twinned" teacher and involve this year's class in some twinning activities. Teachers and students will receive three newsletters throughout the program outlining interesting projects other classes are doing, listing resource material and publishing final results with maps. The cost for the BARK 90 Program is \$50.00, this includes precipitation monitoring kit, three newsletters, teacher information package and mailing costs.

Teachers are encouraged to used the twinning aspect of the BARK 90 Program in other ways. Exchange of information on issues other than acid rain would be of interest to both educators and students. Cultural as well as scientific projects could be done in conjunction with twinned classes.

If you have a computer and a modem, you can join the BARK Electronic Community, which is part of SciNet, an international network of teachers and students. Check the appropriate box on the registration form to receive more information on how to enhance your students' experience of BARK 90 while increasing their computer literacy.

Teachers should register as soon as possible to ensure a place in the BARK 90 Program and for early twinning. Please note that teachers registering late may be twinned with classes from their own country. If this occurs different geographic regions will be linked wherever possible.

REGISTRATION INFORMATION

Registration Form

School Board/District _____

School Name _____

School Address _____

School Phone _____ School FAX _____

Principal _____

Teacher _____

Grade Level of participating class _____

Teacher's Home Phone _____

Method of Payment

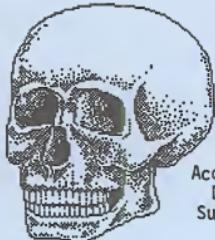
Cost for the BARK 90 Program is \$50.00 per class. Payment method must accompany this registration form.

Ch

Money order

P.O. Number _____

Please send me more information about SciNet's BARK Electronic Community.
Mail this registration form to: Public Focus, BARK 90, 489 College St. Suite 500,
Toronto, ON, Canada M6G 1A5



Montana



RESIDENT AND NON-RESIDENT AIDS CASES
Acquired Immunodeficiency Syndrome (AIDS)
Definitive and Presumptive AIDS Cases
Surveillance Report - 12/1/89 to 12/31/89

1. Disease Category	Adult/Adolescent		2. Age	Cases (%)
	Cases (%)	Deaths (%)		
PCP	28 (49)	18 (51)	Under 13	0 (0)
Other Disease w/o PCP	26 (46)	17 (49)	13-19	0 (0)
KS Alone	3 (5)	0 (0)	20-29	18 (32)
No Diseases Listed	0 (0)	0 (0)	30-39	25 (43)
Total	57 (100)	35 (100)	40-49	9 (16)
			Over 49	5 (9)
			Unknown	0 (0)
			Total	57 (100)

3. Race/Ethnicity	Adult/Adolescent	
	Cases (%)	
White, Not Hispanic	52 (90)	
Black, Not Hispanic	1 (2)	
Hispanic	2 (4)	
Native American	2 (4)	
Unknown	0 (0)	
Total	57 (100)	

4. Patient Groups	Adult/Adolescent		Total (%)
	Males (%)	Females (%)	
Homosexual or Bisexual Men	34 (64)	0 (0)	34 (59)
Intravenous (IV) Drug User	6 (12)	0 (0)	6 (11)
Homo/Bi IV Drug User	6 (12)	0 (0)	6 (11)
Hemophiliac	3 (6)	0 (0)	3 (5)
Heterosexual Contact	0 (0)	4 (80)	4 (7)
Transfusion With Blood/ Products	0 (0)	0 (0)	0 (0)
None of the Above/Other	3 (6)	1 (20)	4 (7)
Total	52 (100)	5 (100)	57 (100)

Source: Montana AIDS Program, MDHES, through December 31, 1989.

*Includes 41 Montana AIDS cases and 16 cases reported to Centers for Disease Control from other states who are living in Montana.

As of December 31, 1989 there have been 236 positive HIV tests from 18,211 tests conducted through the MDHES Public Health Laboratory.

Nationally, as of November 30, 1989, 115,158 cases of AIDS and 68,441 deaths have been reported to the Centers for Disease Control.

The MSTA Board of Directors wishes
every teacher a very happy Easter season.

postage

Editor-in-Chief Richard A Menger, MST
Biology Department, Baker High School
Box 659, Baker, Montana 59313-0659



MSTA will help the individual participate in determining the destiny of science in Montana. The organization serves as a vehicle for educators from all professions to exert positive influences on young people. Many important decisions concerning the scope and direction of science education will be strongly influenced by our organization.

MSTA goals are to increase public awareness, interest and support of science education in Montana.

Montana Science Teachers Association



Membership Category:

1 year	\$ 10.00
2 years	\$ 17.00
3 years	\$ 24.00
Life	\$100.00
Student /Retired	\$ 3.00

Membership dues are \$10.00 and are payable to Doug Shenkle, Treasurer, 1300 Billings Ave., Helena, Montana 59601. Membership includes a one-year subscription (4 issues) to *The Montana Science Teachers Association Newsletter*.